

classical attainments? Far be it from scientific men to belittle these or any other accomplishments—philosophical, literary, or artistic. Our contention is that—along with the more advanced study of the natural sciences—these other branches of learning should be treated as subjects of special education: that they ought not to dominate the general education of the country. So far from having any wish to kill all other learning, we desire to promote *all* learning, but that desire does not prevent us from thinking that training in science will have to take the place in schools which is now occupied by Greek and Latin.

I am aware that our opponents may retort we have no right to assume that persons who have had training in science as an integral part of their education are more competent to manage the affairs of the nation or to carry on business or industrial operations than those who do not possess this advantage. We possess, however, an example of the influence of scientific training on efficiency in one of the largest of our public departments—the Navy. This is admitted, even, I believe, by “Maga,” to be the best organised of those departments; it is certainly the one in which the public places the most confidence. But the men upon whom this efficiency depends are distinguished from those of all other public Services in the fact that their education is, from the beginning, purely scientific. They have had no opportunity for the acquisition of that knowledge of the classics which “Maga” appears to consider necessary for the making of men; yet even the boys of the Navy have again and again demonstrated by their actions that the scientific training which they have received has not prevented them from showing of what stuff they are made.

Nor has “Maga” the right to assume that it is only the classical members of our ancient universities who have come forward so splendidly in this crisis of our national life. For, side by side with those of their classical fellows, “stand imperishable upon the roll of honour” the names of hundreds of science students who have—whether “from their despised studies” or not I cannot say—also “learned and taught the habit of command,” and many of whom have, alas! also made the supreme sacrifice. But to anyone with a “sense of proportion,” it must be obvious that this can have nothing to do with the question at issue. For in showing their readiness to give their lives for their country the members of the universities are doing no more than is being done by millions of their fellow-subjects at home and abroad.

E. A. SCHÄFER.

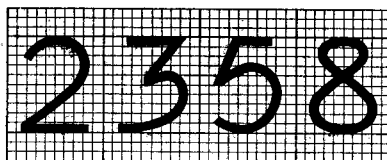
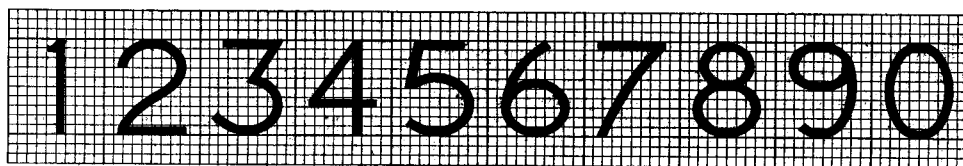
Numerals for Scales and Punches.

SEEING that excellently designed numerals are common on the scales of instruments, and bad styles are rare, I have been surprised at the interest which has been taken by engineers and others in the proposed numerals which were illustrated in NATURE of February 24. I have adopted some of the suggestions which I have received in the revised set here illustrated. My intention eight years ago was to produce designs suitable for the scales of measuring instruments and for the dials of engine counters and electric supply meters, where the numerals appear through holes. Most of the suggestions which I have received since my paper appeared in the Journal

of the Institution of Electrical Engineers relate to numerals punched on metal.

There are four classes of numeral characters: (1) For writing, including ordinary script, formal writing, inscriptions moulded in metal or cut in stone; (2) for typography; (3) for scales; and (4) for punches. Script demands legibility first, but gives considerable scope for calligraphy. In formal writing these requirements are reversed, and for inscriptions they carry equal weight. Typography makes certain intricate and subtle exactions for the purpose of producing balance and apparent uniformity of the characters. Such refinements do not seem to be required in the case of scales and punches. Scales often have to be read in a bad light, and, as I have said in my paper, elegance of shape is not to be disregarded altogether, but wherever necessary it must be sacrificed to legibility and to special restrictions in uniformity of size and thickness of line.

Punches for stamping numerals on metal make two additional demands on the designer. The first is that a character when inverted shall not be mistaken for another; the second is that if the impression is imperfect it shall do its best to be legible. The first case



consists essentially of the relation of the 6 to the 9, and it is so difficult to make a difference, that other numerals must lend their help. The 1 therefore should have a

small serif, and there should be a marked difference between the upper and the lower part of the 8. I propose to retain my original 6, and I offer a 9 with a tail curling up a little to the left, but not enough to cause confusion with 8 or 0. In these numerals the thickness of the line is $7\frac{1}{2}$ per cent. of the height.

The 2 in the present set is a compromise between the swan-breasted one of the first set, and the acute angled type. I have tried to improve the 3 by adding one unit to the length of the top bar, but this has the drawback that if the lower $6/10$ ths is lost there may be a confusion with 7. The tail of the 3 is turned up higher than that of the 5 or 9. The 4, 6, 7, and 0 remain as before. For the sake of appearance the down stroke of the 5 slopes 1 in 10, instead of 1 in 20. Good impressions of the upper $4/10$ ths of these numerals should be legible. If the lower halves only appear, the difference between 3 and 5 is but slight, and there is no difference between the lower half of the 6 and of the 8. But if the lower $6/10$ ths are visible, I think that each numeral is legible. If $4/7$ ths of the breadth are lost on either side the remaining $3/7$ ths are legible.

I have shown these numerals to a friend, who said, “They are quite clear but quite beastly,” and he pointed out that the limitations do not altogether preclude beauty of form. He directed my attention to certain good models, and I have based on these a 2, 3, 5, and 8. The 8 has the advantage that the lower half differs from that of 6.

I shall be glad to receive any further suggestions.

I have a few copies of my paper, and will send one to anybody who has not access to the *Journal of the Institution of Electrical Engineers*, and who is specially interested in the subject.

A. P. TROTTER.

Athenæum Club, Pall Mall, London.

International Latin.

I HAVE always shared the regret of your correspondents that Latin has now ceased to be employed as the international language of science, although for more than a thousand years after it had ceased to be a vernacular it had, among men of education, maintained its position as a living language, adapting itself to the varying needs of the times. I have devoted some attention to the development during the Middle Ages and succeeding centuries of the branches of science in which I am more especially interested, and have been struck by the clear, fluent Latin in which the majority of the scientific treatises were written. That of Agricola, Encelius (Entzelt), Gesner, Camden, and Cæsalpinus in the sixteenth century; Francisco Imperato and Aldrovandi in the seventeenth; and Isaac Lawson, Cramer, and Linnæus in the eighteenth, and most of their fellow-workers is, as a rule, as easy to follow as French, in spite of the handicap of the want of articles, the most serious defect of Latin.

It was the Latinists themselves who were primarily responsible for the modern disuse of the language. They insisted that the diction of Cicero, rather than that of Pliny, should be followed, and as they spoke with authority, there was no one hardy enough to contradict them, so that the unfortunate man of science had to face a hail of ridicule if he failed to reproduce the mannerisms which were held up for his imitation, while if he succeeded his pages were almost unreadable for most of those who would have been interested in their contents.

If Latin were ever again to come into use for scientific purposes, it would only be by assimilating its style and idioms to those of its daughter languages at the present time, by accommodating itself to the changes of meaning which have overtaken so many of its words, and by borrowing freely from their vocabulary, especially in the case of terms which are practically international. At the same time the inflexions and syntax of classical Latin would be generally, but not slavishly, followed.

I am afraid, however, that it is too late to undo the work of those who have slain the object of their affections by strenuous efforts to renew the golden age of its early youth when by far the more important portion of its long career of usefulness still lay before it; and now that it is, as it would seem, really dead, had we not better regretfully but resolutely bury it out of sight and turn our thoughts to the flexible idiom handed down to us by our forefathers, which is already understood throughout the whole civilised world?

JOHN W. EVANS.

Imperial College of Science and Technology,
South Kensington, March 28.

Osmotic Pressure or Osmotic Suction—Which?

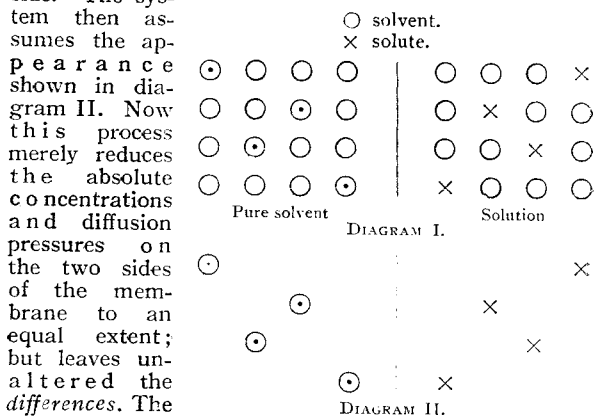
THE interesting controversy between Profs. van Laar and Ehrenfest, referred to in *NATURE* of March 16, again raises the question of the cause for the approximate equality between osmotic pressure and gas pressure. In this connection the following simple proof, based on the kinetic theory, of van't Hoff's well-known relationship, may be of interest.

The tendency of a liquid to diffuse is measured by its diffusion pressure, which may be defined as the bombardment pressure exerted by the liquid molecules on either side of a plane of unit

area placed anywhere within the liquid. If we regard a perfect liquid as formed by the compression of a perfect gas until the molecules almost touch one another, it will be seen that the diffusion pressure is proportional to the number of molecules in unit volume, or the absolute concentration, and also to the absolute temperature. The diffusion pressure for ordinary liquids has a very large value. For instance, if water were a perfect liquid, its diffusion pressure would be about 1200 atmospheres.

Since the absolute concentration of a solvent is reduced by the introduction of a solute, it is evident that diffusion pressure is reduced in the same way; so that the diffusion pressure of the solvent in a solution is always less than that in the pure solvent itself. Hence solvent travels across a membrane from the pure solvent side to the solution side, unless a hydrostatic pressure equal to the difference between the two diffusion pressures is placed on the solution. The osmotic pressure, which is defined as the aforesaid hydrostatic pressure, is therefore proportional to the difference between the absolute concentrations of the solvent on the two sides of the membrane. Further, it is also approximately proportional to the concentration of the solute because the latter is itself approximately equal to the difference in solvent concentration on the two sides, since the process of solution consists essentially in the spatial replacement of part of the solvent molecules by a more or less equal number of solute molecules.

Next as regards the gas relationship. Consider the case of a pure solvent separated from its solution by means of a semipermeable membrane (diagram I.). Remove from the solution side *all* the solvent molecules; and also an equal number from the pure solvent side. The system then assumes the appearance shown in diagram II. Now this process merely reduces the absolute concentrations and diffusion pressures on the two sides of the membrane to an equal extent; but leaves unaltered the differences. The residue of solvent molecules [○] will diffuse across the membrane just as before; whilst the solute molecules will bombard the membrane. Moreover, the pressure of the solvent residue on the one side will be equal to the pressure of the solute on the other; and both will be equal to the corresponding gas pressure, since the molecules are at distances from one another comparable to gas distances. Hence to prevent the residue of solvent from flowing across the membrane, a hydrostatic pressure equal to the gas pressure will have to be applied. The usual way of doing this is to make the solution into a kind of piston.



On the other hand, the solute bombards the membrane with a pressure equal to the corresponding gas pressure, whether a hydrostatic pressure is placed on the solution or not. The solvent itself can exert no pressure on the membrane, since it is supposed to be able to travel across the membrane just as if the latter were non-existent.